

What is claimed is:

1. Glass collectively comprising at least 70 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and containing not more than 30 percent by weight collectively  $\text{As}_2\text{O}_3$ ,  $\text{B}_2\text{O}_3$ ,  $\text{GeO}_2$ ,  $\text{P}_2\text{O}_5$ ,  $\text{SiO}_2$ ,  $\text{TeO}_2$ , and  $\text{V}_2\text{O}_5$ , based on the total weight of the glass.
2. The glass according to claim 1, wherein if  $\text{Al}_2\text{O}_3$ , at least one of  $\text{Y}_2\text{O}_3$  or REO, and at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  are present, the glass comprises either not greater than 4 or at least 6 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.
3. The glass according to claim 1, wherein if  $\text{Al}_2\text{O}_3$ , at least one of  $\text{Y}_2\text{O}_3$  or REO, and at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  are present, the glass comprises at least 6 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.
4. The glass according to claim 3 collectively comprising at least 75 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass.
5. The glass according to claim 3 collectively comprising at least 80 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass.
6. The glass according to claim 3 collectively comprising at least 85 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass.
7. The glass according to claim 3 collectively comprising at least 90 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass.

8. The glass according to claim 3 collectively comprising at least 99 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass.

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9. The glass according to claim 3 collectively comprising 100 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass.

10 10. The glass according to claim 3 collectively comprising at least 70 percent by weight of  $\text{Al}_2\text{O}_3$ , at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.

11. The glass according to claim 10, wherein the at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  is  
15 present in an amount of at least 5 percent by weight, based on the total weight of the glass.

12. The glass according to claim 10, wherein the at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  is present in an amount of at least 10 percent by weight, based on the total weight of the glass.

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13. The glass according to claim 3 collectively comprising at least 70 percent by weight of  $\text{Al}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$ , and at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.

25 14. The glass according to claim 3, wherein the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  is present in an amount of at least 10 percent by weight, based on the total weight of the glass.

15. The glass according to claim 3 collectively comprising at least 70 percent  
30 by weight of  $\text{Y}_2\text{O}_3$ , at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ .

16. The glass according to claim 15, wherein the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  is present in an amount greater than 5 percent by weight, based on the total weight of the glass.

5 17. The glass according to claim 15, wherein the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  is present in an amount of at least 10 percent by weight, based on the total weight of the glass.

10 18. The glass according to claim 3 comprising greater than 5 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.

19. The glass according to claim 3 comprising at least 10 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.

15 20. The glass according to claim 3 comprising at least 15 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.

20 21. The glass according to claim 3 comprising at least 20 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.

22. The glass according to claim 3 comprising at least 25 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.

25 23. The glass according to claim 3 comprising the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , in a range from 10 to 40 percent by weight, based on the total weight of the glass.

24. The glass according to claim 3 collectively comprising at least 70 percent by weight of  $\text{Al}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$ , at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.

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25. The glass according to claim 24, wherein the at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  is present in an amount of at least 5 percent by weight, based on the total weight of the glass.

26. The glass according to claim 24, wherein the at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  is present in an amount of at least 10 percent by weight, based on the total weight of the glass.

27. Ceramic comprising the glass according to claim 3.

28. A method for making the glass according to claim 3, the method comprising:  
melting sources of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  to provide a melt; and cooling the melt to provide the glass.

29. A method for making ceramic comprising glass according to claim 3, the method comprising:  
melting sources of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  to provide a melt; and cooling the melt to provide the ceramic.

30. A method for making an article comprising glass according to claim 3, the method comprising:  
providing glass powder comprising glass, the glass collectively comprising at least 70 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and containing not more than 30 percent by weight collectively  $\text{As}_2\text{O}_3$ ,  $\text{B}_2\text{O}_3$ ,  $\text{GeO}_2$ ,  $\text{P}_2\text{O}_5$ ,  $\text{SiO}_2$ ,  $\text{TeO}_2$ , and  $\text{V}_2\text{O}_5$ , wherein if  $\text{Al}_2\text{O}_3$ , at least one of  $\text{Y}_2\text{O}_3$  or  $\text{REO}$ , and at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  are present, the glass comprises at least 6 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass, the glass having a  $T_g$ ; and

heating the glass powder above the  $T_g$  such that the glass beads coalesce to form a shape and provide the article.

- 5           31.     An optical waveguide comprising:  
              a substrate; and  
              a glass according to claim 3 on a surface of the substrate.

- 10           32.     The optical waveguide according to claim 31, wherein the glass is doped with a rare earth dopant.

- 15           33.     The optical waveguide according to claim 32 wherein the rare earth dopant is selected from the group consisting of cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, or their other compounds and mixtures thereof.

34.     An optical waveguide comprising a glass fiber having a core material and a cladding surrounding the core material, wherein the core material comprises a glass according to claim 3.

- 20           35.     The optical waveguide according to claim 34, wherein the glass is doped with a rare earth dopant.

- 25           36.     The optical waveguide according to claim 35, wherein the rare earth dopant is selected from the group consisting of cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, or their other compounds, and mixtures thereof.

37. An optical amplifier comprising:  
an optical pump source which provides optical pump light; and  
an optical waveguide coupled to receive the optical pump light from  
the optical pump source, wherein the optical waveguide comprises a glass  
according to claim 3.

38. The optical amplifier according to claim 37, wherein the glass is doped with  
a rare earth dopant.

39. The optical amplifier according to claim 38, wherein the rare earth dopant  
is selected from the group consisting of cerium, praseodymium, neodymium, promethium,  
samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium,  
ytterbium, or their other compounds, and mixtures thereof.

40. A method for amplifying optical signals, the method comprising:  
inputting the optical signals to an optical waveguide comprising a glass  
according to claim 3; and  
applying pump light to the optical waveguide to cause the waveguide to  
provide optical gain to the optical input signals.

41. The method according to claim 40, wherein the glass is doped with a rare  
earth dopant.

42. Ceramic comprising at least 75 percent by volume glass, the glass  
collectively comprising at least 70 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$   
and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and  
containing not more than 30 percent by weight collectively  $\text{As}_2\text{O}_3$ ,  $\text{B}_2\text{O}_3$ ,  $\text{GeO}_2$ ,  $\text{P}_2\text{O}_5$ ,  
 $\text{SiO}_2$ ,  $\text{TeO}_2$ , and  $\text{V}_2\text{O}_5$ , based on the total weight of the glass.

43. The ceramic according to claim 42, wherein if  $\text{Al}_2\text{O}_3$ , at least one of  $\text{Y}_2\text{O}_3$  or REO, and at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  are present, the glass comprises either not greater than 4 or at least 6 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.

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44. The ceramic according to claim 42, wherein if  $\text{Al}_2\text{O}_3$ , at least one of  $\text{Y}_2\text{O}_3$  or REO, and at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  are present, the glass comprises at least 6 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.

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45. Glass-ceramic collectively comprising at least 70 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and containing not more than 30 percent by weight collectively  $\text{As}_2\text{O}_3$ ,  $\text{B}_2\text{O}_3$ ,  $\text{GeO}_2$ ,  $\text{P}_2\text{O}_5$ ,  $\text{SiO}_2$ ,  $\text{TeO}_2$ , and  $\text{V}_2\text{O}_5$ , based on the total weight of the glass-ceramic.

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46. The glass-ceramic according to claim 45, wherein if  $\text{Al}_2\text{O}_3$ , at least one of  $\text{Y}_2\text{O}_3$  or REO, and at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  are present, the glass-ceramic comprises either not greater than 4 or at least 6 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass-ceramic.

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47. The glass-ceramic according to claim 45, wherein if  $\text{Al}_2\text{O}_3$ , at least one of  $\text{Y}_2\text{O}_3$  or REO, and at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  are present, the glass-ceramic comprises at least 6 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass-ceramic.

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48. The glass-ceramic according to claim 47 collectively comprising at least 75 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass-ceramic.

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49. The glass-ceramic according to claim 47 collectively comprising at least 80 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass-ceramic.

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50. The glass-ceramic according to claim 47 collectively comprising at least 85 percent by weight (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass-ceramic.

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51. The glass-ceramic according to claim 47 collectively comprising at least 90 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass-ceramic.

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52. The glass-ceramic according to claim 47 collectively comprising at least 95 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass-ceramic.

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53. The glass-ceramic according to claim 47 collectively comprising at least 99 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass-ceramic.

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54. The glass-ceramic according to claim 47 collectively comprising 100 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , based on the total weight of the glass-ceramic.



55. The glass-ceramic according to claim 47 collectively comprising at least 70 percent by weight of  $\text{Al}_2\text{O}_3$ , at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass-ceramic.

5 56. The glass-ceramic according to claim 55, wherein the at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  is present in an amount of at least 5 percent by weight, based on the total weight of the glass-ceramic.

10 57. The glass-ceramic according to claim 55, wherein the at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  is present in an amount of at least 10 percent by weight, based on the total weight of the glass-ceramic.

15 58. The glass-ceramic according to claim 47 collectively comprising at least 70 percent by weight of  $\text{Al}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$ , and at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass-ceramic.

20 59. The glass-ceramic according to claim 58, wherein the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  is present in an amount of at least 10 percent by weight, based on the total weight of the glass-ceramic.

60. The glass-ceramic according to claim 47 collectively comprising at least 70 percent by weight of  $\text{Y}_2\text{O}_3$ , at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ .

25 61. The glass-ceramic according to claim 50, wherein the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  is present in an amount greater than 5 percent by weight, based on the total weight of the glass-ceramic.

30 62. The glass-ceramic according to claim 60, wherein the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  is present in an amount of at least 10 percent by weight, based on the total weight of the glass-ceramic.

63. The glass-ceramic according to claim 47 collectively comprising at least 70 percent by weight of  $\text{Al}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$ , at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass-ceramic.

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64. The glass-ceramic according to claim 63, wherein the at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  is present in an amount of at least 5 percent by weight, based on the total weight of the glass-ceramic.

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65. The glass-ceramic according to claim 63, wherein the at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  is present in an amount of at least 10 percent by weight, based on the total weight of the glass-ceramic.

15 66. A method for making glass-ceramic according to claim 47, the method comprising:

heat-treating glass to convert at least a portion of the glass to crystalline ceramic and provide the glass-ceramic, the glass collectively comprising at least 70 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and containing not more than 30 percent by weight  
20 collectively  $\text{As}_2\text{O}_3$ ,  $\text{B}_2\text{O}_3$ ,  $\text{GeO}_2$ ,  $\text{P}_2\text{O}_5$ ,  $\text{SiO}_2$ ,  $\text{TeO}_2$ , and  $\text{V}_2\text{O}_5$ .

67. A method for making glass-ceramic according to claim 47, the method comprising:

25 heat-treating ceramic comprising glass to convert at least a portion of the glass to crystalline ceramic to provide the glass-ceramic, the glass collectively comprising at least 70 percent by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ , or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and containing not more than 30 percent by weight collectively  $\text{As}_2\text{O}_3$ ,  $\text{B}_2\text{O}_3$ ,  $\text{GeO}_2$ ,  $\text{P}_2\text{O}_5$ ,  $\text{SiO}_2$ ,  $\text{TeO}_2$ , and  $\text{V}_2\text{O}_5$ .

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68. A method for making a glass-ceramic article, the method comprising:  
providing glass powder, the glass collectively comprising at least 70 percent  
by weight of (i) at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$  and (ii) at least two of (a)  $\text{Al}_2\text{O}_3$ , (b)  $\text{Y}_2\text{O}_3$ ,  
or (c) at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$ , and containing not more than 30 percent by weight  
5 collectively  $\text{As}_2\text{O}_3$ ,  $\text{B}_2\text{O}_3$ ,  $\text{GeO}_2$ ,  $\text{P}_2\text{O}_5$ ,  $\text{SiO}_2$ ,  $\text{TeO}_2$ , and  $\text{V}_2\text{O}_5$ , based on the total weight of  
the glass, the glass having a  $T_g$ ;  
heating the glass powder above the  $T_g$  such that the glass powder coalesces  
to form a shape and provide a glass article; and  
heat-treating the glass article to convert at least a portion of the glass to  
10 crystalline ceramic to provide the glass-ceramic article.

69. The method according to claim 68, wherein if  $\text{Al}_2\text{O}_3$ , at least one of  $\text{Y}_2\text{O}_3$   
or REO, and at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  are present, the glass comprises either not greater  
than 4 or at least 6 percent by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the  
15 total weight of the glass.

70. The method according to claim 68, wherein if  $\text{Al}_2\text{O}_3$ , at least one of  $\text{Y}_2\text{O}_3$   
or REO, and at least one of  $\text{ZrO}_2$  or  $\text{HfO}_2$  are present, the glass comprises at least 6 percent  
by weight of the at least one of  $\text{Nb}_2\text{O}_5$  or  $\text{Ta}_2\text{O}_5$ , based on the total weight of the glass.  
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